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CDOT BRIDGE DESIGN MANUAL

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### **1.1.1 GENERAL**

The Colorado Department of Transportation Bridge Design Manual provides the policy and procedures currently in effect for the design of bridges and other highway structures on the state highway system and on federally funded off-system projects.

The current AASHTO Standard Specifications for Highway Bridges is the basic document guiding the design of highway structures. The CDOT Bridge Design Manual supplements the AASHTO specifications by providing additional direction. Where discrepancy arises between this manual and the current AASHTO Specifications for Bridges, this manual will control.

Other specifications may be required for structural design, but only as referenced by this manual or the AASHTO Standard Specifications. For example, this manual and the AASHTO Standard Specifications reference the ANSI/AASHTO/AWS D1.5 Bridge Welding Code.

Using this manual does not relieve engineers of their responsibility to provide an adequate final design or to exercise sound engineering judgment. The Staff Bridge Engineer will consider requests to vary from the policies given in this manual when warranted by special conditions and sound engineering judgment. If different interpretations of a given article arise, guidance shall be obtained from the Staff Bridge Engineer or his designee. This manual is issued by the Staff Bridge Engineer and all modifications and variances must be authorized by him or his designee.

A thorough acquaintance with the contents of the Bridge Design Manual is essential for anyone designing structures for the CDOT or for federally funded off-system projects.

Previous editions of the CDOT Bridge Design Manual were titled, or referred to as, "Bridge Manual Volume I", "Bridge Design Policy Memos", "Policy Letters", and "Design Policy and Procedure Manual". These previous editions and titles are now void.

### **1.1.2 DISTRIBUTION AND MAINTENANCE**

Copies of the Bridge Design Manual are obtained from the office of the Staff Bridge Engineer or from Staff Bridge Unit 01224.

The Staff Bridge Engineer's office is responsible for maintaining the computer files and hard-copy originals containing the Design Manual. Staff Bridge Unit 01224 is responsible for coordinating revisions and making copies and updates available. Unit 01224 will also maintain a revision log showing all the revision dates that have transpired for each Subsection and the person who wrote the revision.

Before starting a structural design project, the engineers involved shall obtain a copy of the Design Manual from Unit 01224; or, if they already have a manual, shall inspect a copy of the current table of contents provided by Unit 01224 to make certain their copy of the manual is up-to-date.

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### **1.1.3 REVISIONS**

The Bridge Design Manual is intended to be dynamic. It will continuously incorporate revisions as new material is added and as criteria and specifications change. All revisions shall be approved by, and transmitted from, the office of the Staff Bridge Engineer.

Suggestions for improving and updating the manual are encouraged. Anyone who wishes to propose revisions should informally discuss their changes with other bridge engineers to further develop and refine their ideas. The Staff Bridge Engineer should then be presented with a preliminary draft showing the developed concept.

Alternatively, proposed revisions may be submitted to the Staff Bridge Preconstruction Engineer, or the Staff Bridge unit leader of Unit 01224, who will then present the revisions to the Staff Bridge Engineer.

On deciding to pursue the revisions, the Staff Bridge Engineer will assign them to an engineer. The engineer receiving the assignment is responsible for the final writing, distributing the revisions to all Staff Bridge personnel for their review and comment, making revisions as appropriate based on the comments received, and submitting the final draft to the Staff Bridge Engineer for approval.

Revisions will be made by Subsection. That is, whenever a revision is made, the entire Subsection containing the revision will be reissued. Whenever revisions are issued, they shall be accompanied by a cover document signed by the Staff Bridge Engineer and by an updated Table of Contents showing the new "effective dates" of the revised Subsections. The effective dates in the table of contents provide a ready means to check if a given manual is up-to-date.

### **1.1.4 SUPPLEMENTAL STAFF BRIDGE PUBLICATIONS**

The following material furnished by the Staff Bridge Branch is to be used in conjunction with the CDOT Bridge Design Manual for the development of contract documents. Familiarity with the following material is essential for anyone designing structures for the CDOT or for federally funded off-system projects.

#### **1.1.4.A STAFF BRIDGE ENGINEER MEMORANDUMS**

Memorandums from the Staff Bridge Engineer's office giving direction for structural design shall govern over the contents of the Bridge Design Manual and the AASHTO specifications. These memorandums are issued when expediency is required or as a means for introducing new policy and procedures. These memorandums shall be in effect for one year after their submittal unless designated otherwise by the memorandums. During the one year period the Bridge Design Manual will be revised to include the design requirements given by these memorandums unless otherwise directed by the Staff Bridge Engineer.

#### **1.1.4.B CDOT BRIDGE DETAILING MANUAL**

The CDOT Bridge Detailing Manual provides the policies and procedures for developing and checking contract plans and quantities. This publication was previously referred to as the Bridge Manual Volume II, and the Bridge Detailing and Checking Manual. Copies and revisions to this manual are

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obtained from the Staff Bridge Engineer's Office or from the Staff Bridge Unit 01224.

#### *1.1.4.C CDOT STAFF BRIDGE WORKSHEETS*

The CDOT Staff Bridge Worksheets are plan sheets of standardized bridge details. For further information see Subsection 1.2. In general, the CDOT Standard Plans (M & S Standards) do not provide the standard details used for bridges. There are exceptions to this. For this reason, and because structural details are often dependent on the roadway design standards, familiarity with the M & S Standards, as well as the Staff Bridge Worksheets, is essential.

#### *1.1.4.D BRIDGE RATING MANUAL*

The Bridge Rating Manual is maintained and provided by the Staff Bridge BRIAR/BMS group. This manual provides the policies and procedures for performing and submitting the structural capacity rating of bridges. All bridge designs require the submittal of a bridge rating by the design team.

#### *1.1.4.E PROJECT SPECIAL PROVISIONS*

To assist designers in preparing project special provisions, Staff Bridge maintains a file of the most commonly used structural related project special provisions. For additional information see Subsection 1.3.

#### *1.1.4.F STAFF BRIDGE BRIAR/BMS RECORDS AND PUBLICATIONS*

The records and publications maintained and provided by the Staff Bridge BRIAR/BMS group (Bridge Records, Inspection, Appraisal, Rating and Management Systems group) serve a variety of functions for structural design. Their primary use by bridge designers is for evaluating existing structures for rehabilitation or replacement. Below is a partial list of the records and publications. For further information contact the Staff Bridge BRIAR/BMS office.

*Structure Folders:* Every structure has a file whose contents include the bridge inspection reports, a list of the inventory and appraisal items, and a summary of the structural capacity rating.

*Microfilm files:* The project plans and documents for every structure are kept for the life of the structure on microfilm.

*CDOT Structure Inventory Coding Guide:* This guide lists and explains the structure inventory and appraisal items.

*Field Log of Structures:* This is a catalog of all CDOT structures listed by highway number.

CDOT STAFF BRIDGE WORKSHEETS

## GENERAL

The CDOT Staff Bridge Worksheets are drawings of the department's standardized bridge details. The worksheets define bridge design policy on the details addressed. The details are directly applicable for most projects; however, project specific modifications are sometimes necessary.

These sheets were called "Bridge Standards" in the past. As such, they were occasionally used inappropriately. The current title, "Bridge Worksheets", helps establish that these are predetailed drawings that need checking on a project by project basis for applicability. The worksheet numbers are for identification only and shall be removed at the same time the designer, detailer and checkers initials are placed on the sheet.

All applications of these worksheets shall originate with a copy from the master file. The master file shall not be modified without approval of the Staff Bridge Engineer or his designee.

## DISTRIBUTION AND MAINTENANCE

Staff Bridge Unit 01224 is responsible for coordinating revisions and making copies of the worksheets available. Unit 01224 will maintain a revision log showing all the revision dates that have transpired for each Worksheet, and the engineers and detailers who made the revisions. Unit 01224 is also responsible for maintaining the computer master file and the hard-copy master file.

The computer master file contains all of the current worksheets. It is available to Staff Bridge Personnel for read, print and copy operations only. The senior technician in Unit 01224 and his designee alone have authorization to conduct write and delete operations on this file.

The hard-copy master file contains the revision log and half-size copies of all the current worksheets. It is kept within Unit 01224 and is available to anyone for reference.

Copies from the computer master file can be obtained at any time by Staff Bridge Personnel. A few copies from the half-size hard-copy master file can be obtained at any time from Unit 01224. Obtaining full size vellums, computer files (i.e., tapes or discs), or numerous half-size copies (e.g., copies of all the worksheets), needs to be scheduled at least a day in advance with Unit 01224.

## REVISIONS

The CDOT Staff Bridge Worksheets are intended to be dynamic. The Worksheets will continuously incorporate revisions as new material is added and as criteria and specifications change. All revisions shall be approved by the Staff Bridge Engineer or his designee.

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Suggestions for improving and updating the worksheets are encouraged. Anyone who wishes to propose revisions should informally discuss their changes with other bridge engineers and detailers to further develop and refine their ideas.

The Staff Bridge Engineer should then be presented with a preliminary draft showing the developed concept.

Alternatively, proposed revisions may be submitted to the Staff Bridge Preconstruction Engineer, or the Staff Bridge unit leader of Unit 01224, who will then present the revisions to the Staff Bridge Engineer.

On deciding to pursue the revisions the Staff Bridge Engineer, or his designee, will assign them to an engineer and detailer. The engineer receiving the assignment is responsible for the final design, distributing the revisions to all Staff Bridge personnel for their review and comment, making revisions as appropriate based on the comments received, and submitting the final draft to the Staff Bridge Engineer, or his designee, for approval.

Revised and new worksheets shall have their effective date given in the lower right corner of the drawing. On receiving new and revised worksheets, Unit 01224 will update the master files and the revision log. The effective dates on the drawings and in the revision log provide a ready means to check if a given copy is up-to-date.

Engineers making revisions to the CDOT Staff Bridge Worksheets should also submit to Unit 01224 design notes documenting their revisions. These notes shall describe the changes, why they were made, and provide supporting calculations as appropriate. The notes are to be signed by the engineer and a checker.

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## PROJECT SPECIAL PROVISIONS

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### **GENERAL**

Contract documents are primarily composed of plan sheets and construction specifications. Structural engineers are responsible for the construction specifications, as well as the plan sheets, applicable to their structure. The construction specifications are made up of the CDOT Standard and Supplemental Specifications for Road and Bridge Construction, the Standard Special Provisions, and the Project Special Provisions.

Because the Standard Special Provisions and the Project Special Provisions take precedence over the plan sheets, it is crucial that they be carefully prepared and reviewed by the bridge designer.

Developing the Project Special Provisions is an integral part of the structure design. To assist designers Staff Bridge maintains three Project Special Provision master files (one computer master file and two duplicate hard-copy master files) of the most commonly used provisions related to structures. The provisions on file provide the Staff Bridge policy currently in effect for the subject area.

All structural related Project Special Provisions should originate with a copy from the master files, when the master files have a provision covering the subject area. The master files shall not be modified without approval of the Staff Bridge Engineer or the Staff Bridge Preconstruction Engineer.

### **DISTRIBUTION AND MAINTENANCE**

The Staff Bridge Preconstruction Engineer's office is responsible for maintaining the master files, making copies of the master files available, and coordinating revisions to the master files. The Staff Bridge Preconstruction Engineer's office will also maintain a revision log with each Project Special Provision in the master files.

The revision log lists all the revisions that have transpired for the special provision by showing the date and author of the revision, accompanied by a brief explanation of the revision. Where appropriate, the explanation includes instructions on using the Project Special Provision.

The computer master file contains all of the current Project Special Provisions with their revision logs. The Staff Bridge Administrative Assistant and her designee alone have authorization to conduct write and delete operations on this file.

The hard-copy master files are two loose leaf binders kept by the Staff Bridge Engineer's office containing all of the current Project Special Provisions with their revision logs. These master files are available to anyone for reference or making copies.

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## REVISIONS

Most of the Project Provisions kept on file require little or no revision for most projects (e.g., those addressing bridge rails), while others are very project specific and require heavy revision (e.g., the alter and erect structural steel provision).

Whenever possible, revisions made to prepare a Project Special Provision for a specific project shall be made from a copy of the master files. This is necessary to minimize errors and to insure the latest policies for the subject area are accounted for.

Errors and omissions in the master files, or needed improvements, are to be reported to the Staff Bridge Preconstruction Engineer. The Staff Bridge Engineer or Preconstruction Engineer will assign the necessary changes to an engineer. The engineer receiving the assignment is responsible for the final writing, updating the revision log to include the information described above, and submitting the final draft to the Staff Bridge Preconstruction Engineer for approval and inclusion into the master files.